Geologic Hazard Assessments Subactivity

Program	1999 Estimate	Uncontrol. & Related Chgs	Program Redirect	Program Changes	FY 2000 Budget Request	Change from 1999
Earthquake Hazards	48,560	1,075	-7,120	1,600	44,115	-4,445
Volcano Hazards	19,759	354	-2,845	-250	17,018	-2,741
Landslide Hazards	2,370	60	-237	0	2,193	-177
Global Seismographic Network	**3,831**	**42**	**-392**	**0**	**3,481**	**-350**
Geomagnetism	1,849	50	-296	400	2,003	154
Total Requirements $000	76,369	1,581	-10,890	1,750	68,810	-7,559

Note: The Program Redirect column reflects the redirection of funds to the Integrated Science, Science Support, and Facilities activities.

Global Seismographic Network

Current Program Highlights

The Global Seismographic Network (GSN) is a worldwide network of 107 modern seismographic stations. The GSN has a goal of 150 stations providing high-quality data used to address problems related to disaster management, hazards assessment, national security, loss reduction, and the structure and dynamics of the Earth. GSN is a joint effort involving the USGS, the Incorporated Research Institutions for Seismology (IRIS, a consortium of universities supported by the National Science Foundation), and the Institute for Geophysics and Planetary Physics (IGPP) at the University of California. The network is maintained in cooperation with many international partners who, in most cases, provide facilities to house the instruments and personnel to oversee the security of each station. The majority of GSN stations are operated within the framework of agreements between a host organization (academic institution or foreign government agency) and either the USGS, IRIS, or IGPP.

Funds for the purchase and installation of new GSN stations are provided to IRIS by NSF; the USGS and IGPP install new GSN stations on behalf of IRIS. Once installed, the USGS is responsible for maintenance, data collection, and quality control of about two-thirds of the GSN stations. The minor and routine maintenance at most foreign GSN stations is carried out by host organization personnel who are trained by the USGS. USGS tasks include training station operators, providing major repairs, conducting routine service visits to network stations,

and providing direct financial aid in support of station operations at those sites lacking an indigenous host organization (most of these stations reside within the former Soviet Union). The USGS and IRIS also evaluate, develop, and exploit new technologies in data acquisition and data management and improve station performance by relocating unusually noisy stations to quieter sites or configurations (e.g., placing sensors in boreholes) in order that smaller events (earthquakes or explosions) may be detected. Siting, permitting, and installation of GSN stations are nearing completion. Over the past 5 years, a special effort has been made to accelerate the installation of GSN stations in support of nuclear monitoring efforts. This phase is nearing completion, and GSN is making the transition from development and deployment to operation and maintenance. The planned lifetime of the completed network is 30 years. However, with proper maintenance and gradual upgrades of data system components, GSN will produce data indefinitely and its performance will improve year by year.

Principal end-users of GSN data include the USGS National Earthquake Information Center in Golden, Colorado; Harvard University; the World Data Center in Moscow; the Chinese Digital Seismic Network data center in Beijing; the Center for (Nuclear) Monitoring Research in Arlington, Virginia; and a broad international audience of government and academic researchers. Copies of all the data from USGS GSN stations are sent to the IRIS Data Management Center in Seattle, Washington. The IRIS data center is the distribution point for GSN data to users (such as scientists, engineers, and government agencies) throughout the world; every year it responds to over ten thousand requests for GSN data. In addition, data from over 50 GSN stations are currently available to the worldwide user community via telephone dial-up and (or) Internet connections within hours of large earthquakes. In a typical year there will be tens of thousands of requests for such data from over four hundred large earthquakes.

GSN data are used daily in the routine operations of the USGS National Earthquake Information Center (NEIC). Real-time data are transmitted continuously to the NEIC where they are used, with other data, to determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide. When appropriate, GSN data and parametric reports are provided to the Pacific and Alaskan tsunami warning centers. A unique feature of the GSN data is that they can be used to determine, within an hour, the geometric orientation of the fault that caused the earthquake, and provide estimate of the length of the fault that ruptured during the earthquake. A damaging earthquake near a populated region generates great demand for such information by government officials and scientists responsible for assessing and responding to an earthquake disaster. Such information about significant domestic earthquakes is immediately sent to Federal and State emergency management and public safety agencies, operators of transportation facilities and public utilities, and national news media. Information about potentially damaging foreign earthquakes is immediately sent to the Department of State, embassies and consulates in the affected region, the Office of Foreign Disaster Assistance, the Red Cross, and the United Nations as well as national and international news media.

Recent Accomplishments

Network Status — At the end of FY 1997, 70 GSN stations were maintained by the USGS. During the year, one station near Bogota, Columbia, was closed due to civil unrest within the

country. During FY 1998 new stations were installed in the Galapagos Islands, Mali in western Africa, Johnston Island, and central Florida. Plans call for eight new stations to be installed in FY 1999 and seven in FY 2000. The purchase of equipment and installation of new stations is funded by NSF through IRIS.

Nuclear Test Ban Treaty Monitoring — 34 GSN stations have been formally designated as auxiliary seismic stations of the International Monitoring System (IMS) being established to monitor the Comprehensive Test Ban Treaty (CTBT). The IMS is part of the CTBT Organization located in Vienna, Austria. The IMS GSN data also are used extensively in major research programs conducted by the DOD and the DOE to improve CTBT monitoring. The entire GSN contributes to the ability of the United States' independent capability to monitor this treaty.

In May 1998, India and Pakistan announced that they had conducted underground tests of nuclear weapons. Three of the announced tests were detected by GSN stations in Pakistan, Tibet, and in central Asia. The GSN data made a significant contribution in assessing the relative sizes of these events and estimating the yields of the explosive devices. This episode demonstrated the value of the “dual-use” concept of the GSN, where an open, scientific data collection enterprise can provide useful data not only for research but also for the monitoring of an arms control agreement.

Figure G-3. Seismic data recorded at the USGS/GSN station in Lhasa, Tibet, from underground nuclear explosions in India (top) and Pakistan. These data were used to help determine the relative size of the explosions.

Data Collection and Quality Control — Each day approximately 1,000 megabytes of digital data from the GSN are processed at the USGS Albuquerque Seismological Laboratory (ASL). (Using standard 3.5-inch PC floppy discs, it would take a stack of discs over 7 feet high to store this volume of data). Every tape from every station must be checked to ensure that the station is operating properly and that no errors have been introduced into the data. Seismic equipment is generally reliable and rarely fails intermittently. However, GSN stations can be subject to extended periods of down time due to major equipment failure, or some external event such a power surge, lightening strike, or vandalism. If problems are found steps are taken immediately to troubleshoot and correct the situation. In some case the local operator can carry out the necessary adjustment and repairs, more difficult problems require a site visit by a technician from ASL. Current data availability from USGS/GSN stations is about 80%.

Y2K — Y2K issues presented considerable problems for the GSN. The stations have been installed over almost a decade in various physical settings and with over 22 configurations in software and hardware. Development and testing of new software and hardware was done at the ASL during late 1998 and 1999. In some cases the new software and equipment could be shipped to the station and installed by the local operator, in other cases a technician from ASL needed to visit the station site to make the necessary changes. By mid-1999 all of the software and hardware re-configurations needed to make the GSN Y2K compatible will be completed.

Scientific Research — GSN data continue to be used extensively in scientific research into the physics of the earthquake sources and the internal structure of the Earth. Recent research attention has been given to the fine structure of tectonic plates as they plunge into the Earth's mantle in "subduction" zones (such as exists under our Pacific Northwest) and to the dynamics of large earthquakes. GSN data provide an increased number of opportunities to study earthquakes and earth structure worldwide and apply the results to problems and geologic settings in the United States.